

row. Much window glass was broken by the hail-stones, which measured from one-fourth inch to one inch in diameter.

Cairo, Ill.: between 9.45 and 10.05 p. m. on the 22d a rain and hail storm prevailed. Vegetables were badly cut by the hail-stones, which measured half an inch in circumference.

Duquoin, Perry Co., Ill.: about 5 p. m. on the 22d a tornado passed through the southern limit of this town, demolishing outbuildings, fences, etc. The storm was of very short duration and moved from west to east.

Mobile, Ala.: a rain and hail storm of unusual severity passed over this city and the adjacent country on the 23d, lasting from 3.35 until 4.30 p. m. The fall of rain amounted to 2.74 inches, 2.60 of which fell in one hour. The streets of the city were flooded to such an extent as to be rendered impassable. Great damage was done to orchards and gardens through a section about a mile wide, extending through Mobile county.

Garden City, Finney Co., Kans.: reports from Coolidge,

Hamilton Co. (in the extreme western part of Kansas), state that a violent hail storm occurred there on the afternoon of the 26th, the hail-stones being unusually large.

Pratt, Pratt Co., Kans.: during the afternoon of the 26th several houses were destroyed at this place by a violent storm. Many persons were badly injured by the flying debris of wrecked buildings.

Wa Keeney, Trego Co., Kans.: reports state that several houses were blown down at Millbrook, Graham Co. (about twenty miles north of Wa Keeney), by a storm which occurred during the evening of the 26th.

Hubbard, Hill Co., Tex.: a destructive tornado is reported to have occurred during the evening of the 26th seven miles south of this place, its path about one hundred yards wide.

#### WATER-SPOUT.

Jacksonville, Fla.: several persons report having observed a water-spout in Saint John's River at 12.25 p. m., 18th.

### INLAND NAVIGATION.

#### STAGE OF WATER IN RIVERS AND HARBOURS.

In the following table are shown the danger-points at the various stations, the highest and lowest depths for April, 1888, with the dates of occurrence and the monthly ranges:

*Heights of rivers above low-water mark, April, 1888 (in feet and tenths).*

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La. ....	29.9	1	24.8	17, 18, 19	20.5	4.3
<i>Arkansas River:</i>						
Fort Smith, Ark. ....	22.0	30	16.3	7, 8	3.0	13.3
Little Rock, Ark. ....	23.0	15	17.5	29	4.7	12.8
<i>Missouri River:</i>						
Omaha, Nebr. ....	18.0	19	15.9	1	8.8	7.1
Leavenworth, Kans. ....	20.0	21	17.5	1	11.7	5.7
<i>Mississippi River:</i>						
Saint Paul, Minn. ....	14.5	14	14.4	7	3.8	10.6
La Crosse, Wis. ....	24.0	18, 19, 20	14.8	1, 2	4.7	10.1
Dubuque, Iowa ....	16.0	24, 25	20.2	4	6.1	14.1
Davenport, Iowa ....	15.0	28	16.1	4, 5	5.9	10.2
Keokuk, Iowa ....	14.0	30	16.1	7, 8	8.1	8.0
Saint Louis, Mo. ....	32.0	24	23.3	7	18.9	4.4
Cairo, Ill. ....	40.0	3, 4, 5, 6	45.3	30	24.9	20.4
Memphis, Tenn. ....	34.0	10, 11, 12	35.2	30	23.6	11.6
Vicksburg, Miss. ....	41.0	26	44.2	1	32.5	11.7
New Orleans, La. ....	13.0	26, 28	14.9	1	11.4	3.5
<i>Ohio River:</i>						
Pittsburg, Pa. ....	22.0	7	15.9	30	3.3	12.6
Cincinnati, Ohio ....	50.0	1	39.9	30	14.0	25.9
Louisville, Ky. ....	25.0	1	16.4	25, 26, 27, 30	7.1	9.3
<i>Cumberland River:</i>						
Nashville, Tenn. ....	40.0	1	38.1	30	5.1	33.0
<i>Tennessee River:</i>						
Knoxville, Tenn. ....	33.0	1	23.6	30	4.6	19.0
Chattanooga, Tenn. ....	33.0	1	23.6	30	4.6	19.0
<i>Monongahela River:</i>						
Pittsburg, Pa. ....	29.0	7	15.9	30	3.3	12.6
<i>Savannah River:</i>						
Augusta, Ga. ....	32.0	1	21.7	30	8.3	13.4
<i>Sacramento River:</i>						
Red Bluff, Cal. ....	.....	1	5.3	29	2.1	3.2
Sacramento, Cal. ....	.....	25	18.3	8-12	16.3	2.0
<i>Willamette River:</i>						
Portland, Oregon ....	.....	28, 29, 30	9.3	6, 7, 11, 12	4.2	5.1

#### OPENING OF NAVIGATION—ICE IN RIVERS AND HARBOURS.

*Connecticut River.*—Hartford, Conn.: the steamer "City of Springfield," the first boat of the season, arrived on the 1st.

*Hudson River.*—Albany, N. Y.: the ice dam at Barren Island broke during the night of 2-3d, leaving the river open between this place and New York City.

*Lake Ontario.*—Oswego, N. Y.: schooner "Wm. Jannison," from Whitby, Ontario, arrived on the 14th, and reported having encountered but little ice.

Rochester, N. Y.: the schooners "Caroline March," from Port Hope, Mich., and "Eliza Fisher," from Coburg, Ontario, arrived on the 8th.

*Lake Erie.*—Buffalo, N. Y.: steamer "J. O. Gilchrist" cleared for Chicago on the 28th, forcing her way through the ice which still extends as far as the eye can reach.

Sandusky, Ohio: the first boat of the season arrived on the morning of the 9th from Toledo, Ohio.

*Detroit River.*—Detroit, Mich.: steamer "J. C. Gilchrist," from Buffalo, bound for ports on Lake Michigan, passed this place on the 29th, being the first boat of the season.

*Black River.*—Port Huron, Mich.: the river was clear of ice on the 15th.

*Lake Huron.*—Port Huron, Mich.: steamer "Oscoda" arrived from Oscoda, Mich., on the 15th, being the first arrival this season from up the lake.

*Saint Clair River.*—Port Huron, Mich.: floating ice in river 1st to 4th, 8th; steamer "Saint Ignace" arrived from Detroit on the 7th and departed on the 9th.

*Thunder Bay River.*—Alpena, Mich.: the river was clear of ice on the 16th, on which date the steamer "Atlantic" from Detroit, Mich., arrived in bay, but did not reach port, the bay being frozen over, and was compelled to return to Detroit. Steamer "Arundel" from Bay City, Mich., arrived in port at 8.30 a. m., 29th, when navigation for the season was fully opened.

*Strait of Mackinac.*—Mackinaw City, Mich.: the ice boat "Saint Ignace" arrived off Mackinaw Island from Detroit on the 10th, being the first arrival of the season. The ice in the strait began to weaken on the 25th, but it remained firm in the narrows about a mile and a half west of the station.

*Grand Traverse Bay.*—Traverse City, Mich.: ice in the bay moved a distance of about a mile on the 27th, but it was driven back on the 28th; on the 30th drift ice extended about three-fourths of a mile from the shore to open water.

*Lake Michigan.*—Milwaukee, Wis.: at the close of the month navigation was generally resumed, all harbors on the lake being free of ice; the Strait of Mackinac, however, was still closed.

Grand Haven, Mich.: the first boat of the season from Chicago, Ill., arrived during the morning of the 10th.

*Green Bay and Fox River.*—Green Bay, Wis.: ice in river from its mouth to near Lake Winnebago broke up on the 10th. On the 16th the river was clear of ice, and Green Bay was open about one mile from the mouth of the river.

*Lake Superior.*—The observer at Duluth, Minn., reports, under the 30th, "the harbor is nearly clear of ice, and it is expected that the first strong southwesterly wind will break up the ice in the lake."

*Mississippi River.*—Saint Paul, Minn.: the ice dam at the bend of the river below the harbor moved out during the morning of the 9th, and that above the Wabash street bridge moved out about noon of the 10th, leaving the river free of ice. The steamer "Pittsburgh," from Saint Louis, Mo., arrived on the 26th, being the first arrival of the season.

La Crosse, Wis.: navigation was resumed on the 9th; floating ice in river on 11th and 12th.

Dubuque, Iowa: floating ice in river, 2d to 4th; the first steamer of the season arrived on the 11th.

Mr. C. H. Stoddard, of Rock Island, Ill., has kept a record of the opening and closing of the river at that place since 1851, which is given below:

Year.	Opened.	Closed.	Year.	Opened.	Closed.
1851.....		December 16	1871.....	February 25..	December 5
1852.....	March 4.....	December 17	1872.....	March 28.....	November 29
1853.....	March 1.....	December 25	1873.....	March 15.....	December 28
1854.....	March 2.....		1874.....	March 10.....	
1855.....	March 8.....	January 21	1875.....	March 29.....	January 4
1856.....	March 29.....	December 24	1876.....	February 9.....	February 3
1857.....	Dec. 27..(?)..	Open.	1877.....	February 21..	Open.
1858.....	March 21.....	January 29	1878.....		December 19
1859.....		December 20	1879.....	March 8.....	December 17
1860.....	March 3.....	December 22	1880.....	January 6.....	November 21
1861.....	March 2.....	December 28	1881.....	April 15.....	Open.
1862.....	March 23.....	Open.	1882.....		December 18
1863.....		December 18	1883.....	March 17.....	December 14
1864.....	March 2.....	December 7	1884.....	March 24.....	December 17
1865.....	March 6.....	December 12	1885.....	March 29.....	December 14
1866.....	March 7.....	December 27	1886.....	March 16.....	December 1
1867.....	April 6.....	December 8	1887.....		November 29;
1868.....	March 12.....	December 9	1888.....	March 18.....	December 24
1869.....	February 13..				
1870.....	March 24.....	January 18			

*The Red River of the North.*—Moorhead, Minn.: ice in river moved out rapidly on the 17th; navigation was resumed on the 23d; steamers "Grandin" and "Pluck" arriving on the latter date.

*Missouri River.*—Fort Buford, Dak.: ice in river began to move between 4 and 5 p. m. on the 10th; the river rose two feet within an hour but in a short while fell about as rapidly as it had risen.

Bismark, Dak.: the ice broke up and moved down the river on the 9th.

Fort Yates, Dak.: the ice in the river began to break up on the 4th; heavy drift ice on 10th and 13th; steamer "Bachelor" arrived on the 22d, being the first boat of the season from points up the river.

Fort Sully, Dak.: ice in river broke up on the 1st; floating ice from the 4th to 7th; navigation was resumed on the 17th, the steamer "General Terry" being the first boat to leave this place.

*Pennsylvania Canal.*—Catawissa, Columbia Co., Pa.: navigation for the season on the north branch of the canal was resumed on the 2d.

#### FLOODS.

Clear Lake, Cerro Gordo Co., Iowa: the heavy rains during the night of the 4th, together with prevailing high temperature, caused a general breaking up of the ice in all streams in this vicinity, and numerous destructive freshets occurred.

Sheboygan, Sheboygan Co., Wis.: the heavy rain during the night of the 4-5th caused the Sheboygan River to reach the highest stage known for a number of years.

Baraboo, Sauk Co., Wis.: the water-works dam at this place was washed out on the 5th.

Waverly, Bremer Co., Iowa: the freshet during the 5th and 6th in Cedar River was the most destructive that has ever occurred here, about one-half of the town being submerged. The tracks of the Waverly Short Line Railroad were two feet under water. The mills at Waverly were compelled to stop work.

Mason City, Cerro Gordo Co., Iowa: destructive freshets occurred in this county during the 5-6th. The town of Rock Falls, on the Shell Rock River, was inundated and an iron bridge washed away.

Sioux City, Iowa, 6th: the freshet in the Missouri River immediately above this place is considered the most destructive that has occurred since 1881, the region inundated being on the Dakota side of the river. It is reported that about four miles of railroad track in the vicinity of Elk Point, Dak., were washed out.

Albany, N. Y.: the water in Hudson River rose rapidly during the night of the 6th and by 7 a. m. on the 7th it had submerged the docks to a depth of two or three feet, causing suspension of business on Quay street.

West Stockbridge, Berkshire Co., Mass.: freshets occurred here during the night of the 6-7th, causing considerable damage to bridges, dams, etc.

Flandreau, Mouda Co., Dak.: on the 7th the Sioux River at this place was higher than has been known during the last six years.

Eau Claire, Eau Claire Co., Wis., 12th: during the last three days the Chippewa and Eau Claire rivers have risen several feet, washing away about one million feet of lumber.

Grand Rapids, Wood Co., Wis.: the bridge over the Wisconsin River between this place and Centralia was washed away by the freshet of the 12th, entailing a loss of \$12,000.

Arcadia, Trempealeau Co., Wis.: Trempealeau River reached a very high stage on the 12th and flooded some of the lower streets.

Berlin, Green Lake Co., Wis.: on the 12th Fox River reached an unusually high stage, compelling the factories here to suspend work. About fifty houses were surrounded by water.

Red Wing, Goodhue Co., Minn., 12th: nearly two miles of railroad track were washed out about seven miles from here.

Saint Paul, Minn., 12th: recent freshets in Zumbrota, Vermillion, and Root rivers have washed away numerous bridges, causing suspension of travel on several railroads. A part of the town of Zumbrota was submerged. At Hastings the Vermillion River reached the highest stage known for many years, and washed away several bridges.

Ama, Buffalo Co., Wis.: on the 17th the water from the Mississippi overflowed a large area in this vicinity, compelling about twenty families to abandon their homes. The damage to property in this section is estimated at \$50,000.

Moorhead, Minn.: the Red River of the North overflowed on the 17th, causing great damage on bottom lands; two bridges, south of this city, are reported to have been carried away.

Prairie du Chien, Crawford Co., Wis.: a considerable part of this place was flooded on the 19th, when the Mississippi was within a few inches of the high-water mark of 1880.

"The Cleveland (Ohio) Leader and Herald" of the 30th contained the following:

SAINT LOUIS, April 29.—Telegrams from the northern cities of Texas report exceedingly heavy rains which have swelled the rivers beyond their banks, inundated the bottoms, and almost swamped towns, causing a great deal of damage to property and an immense amount of good to crops. The Washata River in the Chickasaw Nation has flooded the lowlands, washing away Dougherty Station and a mile of railroad track, including culverts and bridges. The Red River is higher than ever known before. In Choctaw Bayou, a few miles from Sherman, people were compelled to take to the trees on Friday, and were not rescued until yesterday morning. The Texas Pacific Railroad has suffered great damage from washouts, and South Bonham has been overflowed to the depth of four feet in many places. Forty families near Atoka have been compelled to abandon their homes, and reports from Muskogee, Indian Territory, indicate much misfortune throughout the territory.

Gainesville, Cook Co., Tex.: the heavy rains of the 27th and 28th caused great damage. All railroad communication was cut off on account of washouts. A mile of railroad track in the vicinity of Dougherty Station, Chickasaw Nation, Ind. T., is reported to have been entirely washed away and an extensive landslide from Arbuckle Mountain covered several hundred feet of track. The Red River reached an unusually high stage and flooded adjacent portions of the Indian Territory and Texas. Portions of Gainesville were flooded and some dwellings washed away.

Plano, Collin Co., Tex.: the heavy rain which fell here during the night of the 27-28th washed away numerous bridges in this section.

Fort Worth, Tarrant Co., Tex.: the heavy rains of the 27th and 28th caused all streams in this section to rise, the Trinity River reaching the highest stage for past two years.

Denison, Grayson Co., Tex.: the heavy rains of the 27th and 28th caused a large amount of damage to crops, stock, and railroads. The Missouri Pacific Railroad, between this place and Fort Worth, had nearly all bridges washed out or damaged

and twenty miles of the Missouri, Kansas, and Texas tracks between Atoka and Durant, Ind. T., were under water.

Rockwall, Rockwall Co., Tex.: the East Fork of the Trinity River overflowed in this vicinity on the 29th.

Bonham, Fannin Co., Tex.: on the 30th reports from the northern part of this county stated that the Red River was higher than has been known for years, and that all crops in the lowlands had been destroyed.

Navasota, Grimes Co., Tex.: the Brazos, Navasoto, San Jacinto, and Saline rivers have flooded the districts to the south and east of here, causing extensive damage to crops.

Burnet, Burnet Co., Tex., 30th: the recent heavy rains have caused a high stage of water in the Colorado River. Cattle, sheep, drift wood, etc., are seen floating past this place.

Northfield, Vt.: the warm weather on the 28-29th melted the large accumulation of snow in this region causing the Dog River to overflow on the 29th; some outhouses were carried away by the flood.

Hartford, Windsor Co., Vt.: Connecticut and White rivers were higher on the 30th than since the great freshet of 1869.

Croydon, Sullivan Co., N. H.: considerable damage was done by the washing out of a new dam on the 30th.

Concord, N. H.: the lowlands in this vicinity were flooded on the 30th.

Contoocook, Merrimac Co., N. H.: suspension of work in all of the local mills was caused by high water on the 30th.

Biddeford, Me.: the Saco River rose rapidly on the 30th; several saw-mills along the river were compelled to shut down on account of the high water.

The following reports are from stations on the Mississippi:

Saint Paul, Minn.: the river was frozen here from the 1st to the 6th, inclusive; the ice broke up on the 7th, from which date until the 14th the river continued to rise, reaching its highest point on the last-named date, after which it fell a few inches daily until the 28th; it was stationary on the 29th and rose .3 of a foot on the 30th. On the 12th the lower portion of the city called "The Bohemian Settlement," covering about one-third of a square mile, together with lowlands on the opposite side of the river, were flooded to a depth of several feet.

La Crosse, Wis.: at this station the river was about ten feet below the danger-line when at its highest stage from the 18th to 20th; previous to the 18th the river rose steadily, and from the 21st to 30th there was a decline. Only twice since the establishment of the signal office at La Crosse, in 1873, has the Mississippi reached a higher stage than was attained on the 19th, viz., June, 1880, and October, 1881.

Dubuque, Iowa: the river ranged from six to twenty feet, being lowest on the 4th and highest and about stationary from the 22d to the 26th; there was a steady rise from the 7th

to the 25th, and from the latter date to the close of the month a very slight decline; it reached the danger-line on the 19th, and remained above that point until the end of the month, being four feet above the danger-line when at its highest stage. All the islands in this vicinity were under water on the 19th, and portions of east Dubuque were also inundated. On the 22d all saw-mills and many factories suspended operations, and about fifty families were compelled to abandon their houses. The damage from the freshet was comparatively slight.

Davenport, Iowa: the depth of water in the river ranged between six and sixteen feet, there being a gradual rise throughout the month, with the exception of a few dates on which it was stationary or falling slightly. It reached the danger-line on the 24th and remained above it till close of month.

Keokuk, Iowa: the variations in the depth of water at this station between the 1st and 23d were very slight; from the latter date until the close of the month there was a slight but gradual rise, the river reaching its highest point, two feet above danger-line, on the last day of the month. The bottom lands south of Alexandria, Mo., were overflowed to some extent, but no serious damage was done.

Saint Louis, Mo.: the range of water in the river at this place during April was 4.4 feet; it was at no time within 8 feet of the danger-point, and the changes were very gradual.

Cairo, Ill.: the river was highest between the 1st and the 6th, when it was from 4.5 to 5 feet above the danger-line; it was practically below the danger-line after the 11th, and fell gradually from that date till the end of the month, when it was 15 feet below the danger-point. On the 16th the lowlands both above and below Cairo were overflowed for the second time this season, greatly retarding farm work.

Memphis, Tenn.: on the 1st of the month the river was within two feet of the danger-line; it rose very slowly, being about stationary on several dates, until the 12th, when it was one foot above the danger-line; there was a slight but continuous fall subsequent to the 15th.

Vicksburg, Miss.: the river rose daily from the 1st to 24th, and remained about stationary after the latter date; it reached the danger-line on the 14th, and was three feet above that point when at its highest stage on the 26th.

New Orleans, La.: while there were several dates on which the river was about stationary, it rose slowly for the most part during the month; the danger-line was passed on the 8th, and at the close of the month the river was about two feet above that point. The river was running over the levee at Clouett street on the 27th, and the waters from Saint Sophia River submerged the lowlands on the 28th.

HIGH TIDE.

Eastport, Me., 26th.

## ATMOSPHERIC ELECTRICITY.

### AURORAS.

Of the numerous auroral displays which occurred during April the most important were those of the 2d and 11th; these displays were observed over much the same territory, viz., from eastern Montana to New England, and southward to about the fortieth parallel; they were most brilliant in the upper lake region, upper Mississippi valley, and extreme northwest.

The following are some of the descriptions that have reached this office of the auroras above referred to:

Fort Buford, Dak.: the aurora of the 2d first appeared at 9.44 p. m. as a well defined arch over a dark segment, the arch having an altitude of 20° and extending from the northwest to northeast. At 10 p. m. a second arch was formed above the first at an altitude of 35°, and at the same time green and white streamers shot upwards to an altitude of 65°. At 11.35 p. m. the arches had united, and the display had the appearance of a bank of fog. The aurora had disappeared at 12.35 a. m., 3d.

Bismarck, Dak.: an auroral light, extending in a continuous sheet from azimuth 105° to 225° and to an altitude of 60°, was first observed at 10 p. m., 2d; stratus clouds obscured the display at 11.30 p. m. A similar display occurred on 11th, beginning at 9.55 and ending at 11.30 p. m.

Fort Sully, Dak., 2d: an unusually brilliant auroral display was observed from 9.30 to 11.50 p. m.; it consisted of an arch of bright light which rose to altitude 20° and covered one hundred degrees of the horizon; a second arch, from which streamers shot upward about 5°, appeared about two degrees above the first one.

Saint Paul, Minn., 2d: an aurora in the form of a double arch, with limits poorly defined, was observed at 9.35 p. m.; the upper arch had an altitude of 75° and the lower one 45°; at 10.30 p. m. there were three arches, the middle one being somewhat indistinct; at 11 p. m. the upper arch had broadened and become more diffuse and extended to about twenty degrees south of zenith, at the same time the lower arch had risen to